

## NIR 900 – 1700 nm HYPERSPSPECTRAL CAMERAS

Middleton Research offers several different hyperspectral cameras within the 900-1700 nm near-infrared range from Specim Ltd. For the extended wavelength range of 970-2500 nm, please refer to the SWIR hyperspectral camera section. NIR cameras provide high spatial resolution (320 or 640 pixels) and high-speed frame rate of 100-400 Hz, suitable for various on-line chemical imaging applications. Each camera is an integration of an imaging spectrograph (ImSpector N17E) and a monochrome area camera (temperature-stabilized InGaAs sensor) and includes either a USB or CameraLink interface. The spectrographs in the NIR cameras are designed for high light throughput and a distortion-free image on the detector. The NIR hyperspectral cameras are equipped with a software-controlled shutter for dark reference measurements and are available as either cased or uncased.

### Applications

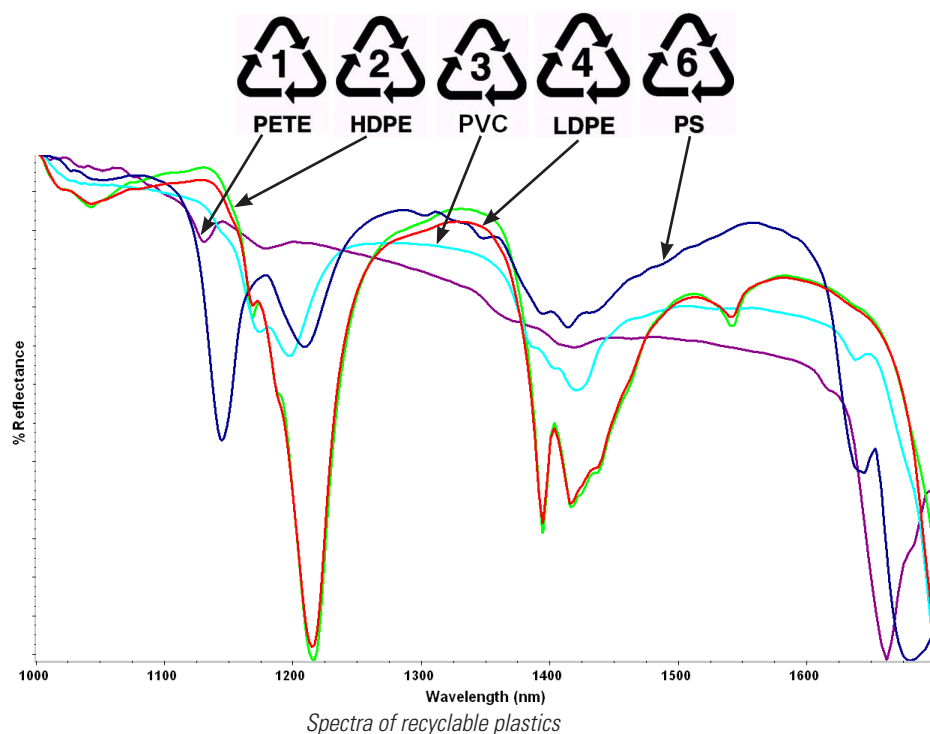
- Moisture profiling
- Food analysis
- Chemical sorting
- Recycling/plastics sorting
- Pharmaceutical quality control
- Medical imaging
- Cosmetics analysis

### Cased Camera Package

- Control unit and shutter
- Power supply
- USB cable (1 for the CameraLink cameras, 2 for the USB cameras)
- National Instruments CameraLink frame grabber and data cable (CameraLink cameras only)
- Control cable
- Power cord set
- Software CD

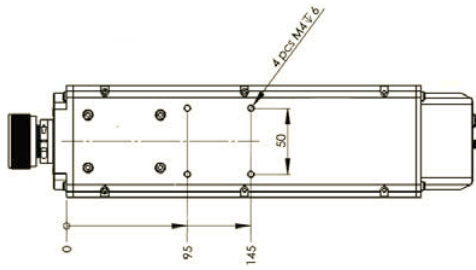
### Uncased Camera Package

- Power supply
- USB cable (1)
- National Instruments CameraLink frame grabber and data cable (CameraLink cameras only)
- Power cord set
- Software CD

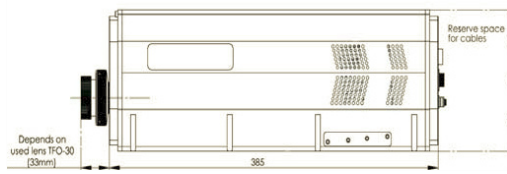




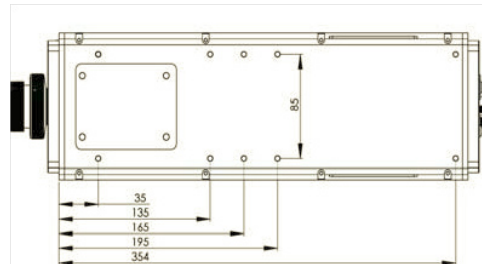
*XL/XF/VL Cased*



*Side view*



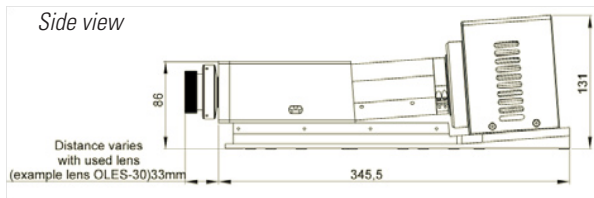
*Bottom view*



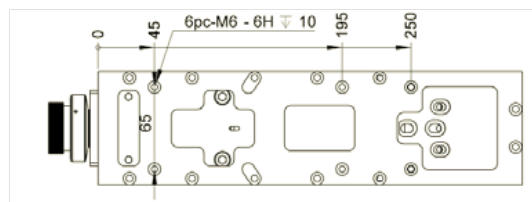
*XL/XF OEM*



*Side view*



*Bottom view*



# NIR 900 – 1700 nm, continued

## HYPERSPPECTRAL CAMERAS

### Cased and Uncased Camera Specifications

Optical Characteristics	XL	XF	VL
Range (nm)	900-1700	900-1700	900-1700
Resolution (spatial x spectral)	320 x 256 (240 active)	320 x 256 (240 active) or 640 x 512	320 x 256 (240 active)
Spectrograph	ImSpector N17E	ImSpector N17E	ImSpector N17E
Spectral Resolution	5 nm (30 µm slit)	5 nm (30 µm slit)	5 nm (30 µm slit)
Spectral Sampling	4 nm/pixel	4 nm/pixel	4 nm/pixel
Spatial Resolution	RMS spot diameter < 30 µm	RMS spot diameter < 30 µm	RMS spot diameter < 30 µm
Aberrations	Insignificant astigmatism, smile or keystone	Insignificant astigmatism, smile or keystone	Insignificant astigmatism, smile or keystone
Numerical Aperture	F/2.0	F/2.0	F/2.0
Slit Width, default	30 µm (18, 50, 80 µm)	30 µm (18, 50, 80 µm)	30 µm (18, 50, 80 µm)
Effective Slit Length	9.6 mm	9.6 mm	9.6 mm
Total Efficiency (typical)	> 50%, independent of polarization	> 50%, independent of polarization	> 50%, independent of polarization
Stray Light	< 0.5 % (halogen lamp, 1400 nm notch filter)	< 0.5 % (halogen lamp, 1400 nm notch filter)	< 0.5 % (halogen lamp, 1400 nm notch filter)

#### Electrical Characteristics

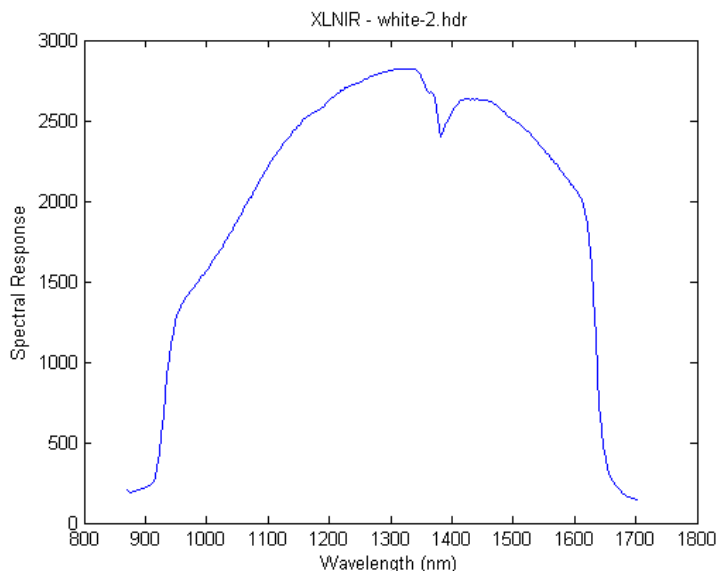
Sensor	TE-cooled InGaAs photodiode array	TE-cooled InGaAs photodiode array	TE-cooled InGaAs photodiode array
Interface	USB or Base CameraLink	Base CameraLink	Base CameraLink
Camera Output	12-bit, USB2, CameraLink	12-bit, USB2, CameraLink	12-bit, CameraLink
Frame rate (full)	100 Hz	120, 350, or 400 Hz	100 Hz
Cooling	Forced convection cooling	Forced convection cooling	Forced convection cooling
Frame Grabber	NI-PCI 1428 (CameraLink Cameras only)	NI-PCI 1428	NI-PCI 1428
Pixel Size	30 x 30 µm	30 x 30 µm	30 x 30 µm
Camera Control	USB or CameraLink	CameraLink	CameraLink
Exposure Time Range	1 µs - 500 ms	1 µs - 500 ms	1 µs - 500 ms
Power Consumption	< 4 W, Cooler - 30 W	< 4 W, Cooler - 30 W	< 30 W
Input Voltage	12 V	12 V	12 V

#### Environmental Characteristics

Storage	-20 to 85 C	-20 to 85 C	-20 to 85 C
Operating	5 to 40 C, non-condensing	5 to 40 C, non-condensing	5 to 40 C, non-condensing

#### Mechanical Characteristics

	XL and XF		VL	
	Uncased	Cased	Uncased	Cased
Size (LxWxH)	350 x 100 x 130 mm	385 x 120 x 135 mm	350 x 100 x 115 mm	385 x 120 x 135 mm
Weight	4.5 kg	5.38 kg	4.4 kg	
Body	Anodized Al w/ mounting screw holes	Anodized Al w/mounting screw holes	Anodized Al w/mounting screw holes	Anodized Al w/mounting screw holes
Lens Mount	Standard C-mount	Standard C-mount	Standard C-mount	Standard C-mount
User Adjustments	None	None	None	None
Shutter	Optional	Yes, w/USB control	Optional	Yes, w/USB control



Spectral response of NIR camera with spectral flattening filter

NIR Cased and Uncased Cameras Ordering Information		
Part Number	Description	Product Name
MRC-303-003-01	NIR Spectral Camera with Enhanced Spectrograph. 100Hz, 320x256 InGaAs, USB, cables included	XLNIR-USB-100-N17E
MRC-302-003-01	OEM NIR Spectral Camera, with Enhanced Spectrograph. 100Hz, 320x256 InGaAs, USB, cables included	XLNIR-USB-100-N17E-OEM
MRC-303-003-02	NIR Spectral Camera with Enhanced Spectrograph; 100Hz, 320x256 InGaAs, CameraLink frame grabber+cable	XLNIR-CL-100-N17E
MRC-302-003-02	OEM NIR Spectral Camera with Enhanced Spectrograph; 100Hz, 320x256 InGaAs, CameraLink frame grabber+cable	XLNIR-CL-100-N17E-OEM
MRC-303-003-06	NIR Spectral Camera with Enhanced Spectrograph.350 Hz, 320x256 InGaAs, CameraLink frame grabber + cable	XFNIR-CL-350-N17E
MRC-302-003-06	OEM NIR Spectral Camera, with Enhanced Spectrograph. 350 Hz, 320x256 InGaAs, CameraLink frame grabber + cable	XFNIR-CL-350-N17E-OEM
MRC-302-003-07	OEM NIR Spectral Camera, with Enhanced Spectrograph. 120 Hz, 640x512 InGaAs, CameraLink frame grabber + cable	XFNIR-CL-120-N17E-OEM
MRC-302-003-08	OEM NIR Spectral Camera, with Enhanced Spectrograph. 400 Hz, 640x512 InGaAs, CameraLink frame grabber + cable	XFNIR-CL-400-N17E-OEM
MRC-303-003-03	NIR Spectral Camera with Enhanced Spectrograph.100Hz, 320x256 InGaAs, Cameralink frame grabber + cable	VLNIR-CL-100-N17E
MRC-302-003-03	OEM NIR Spectral Camera, with Enhanced Spectrograph. 100Hz, 320x256 InGaAs, Cameralink frame grabber + cable	VLNIR-CL-100-N17E-OEM